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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte EVGENIYA FREYDINA,
ANIL D. JHA, FREDERICK WILKINS,
AYTAC SEZGI and RESHMA MADHUSUDAN

Appeal 2009-002825
Application 10/712,685
Technology Center 1700

Decided:[1] July 10, 2009

Before CATHERINE Q. TIMM, JEFFREY T. SMITH, and
MARK NAGUMO, *Administrative Patent Judges*.

Opinion for the Board filed by *Administrative Patent Judge* TIMM.

Opinion Dissenting-in-part filed by *Administrative Patent Judge* Nagumo.

TIMM, *Administrative Patent Judge*.

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[1] The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the Decided Date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1, 3-20, 22, and 27-32. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

I. STATEMENT OF THE CASE

The invention relates to a system and method for treating water. The system incorporates an electrochemical device, such as an electrodialysis ("ED") device or an electrodeionization ("EDI") device, operated to treat water while minimizing water polarization (also referred to as "water splitting" or "hydroxyl generation") (Spec. 1, ll. 7-9; 4, l. 32-5, l. 1). The water treatment system includes an electrochemical device 16 downstream from an initial water supply 14 and downstream from a reservoir 12. Electrochemical device 16 produces treated water that is mixed with water from initial water supply 14 and that is stored in a reservoir system 12 (Spec. 5, ll. 12-15 and 20-22; 9, ll. 25-29 Figure 1).

Figure 1 of Appellants' Specification is reproduced below.

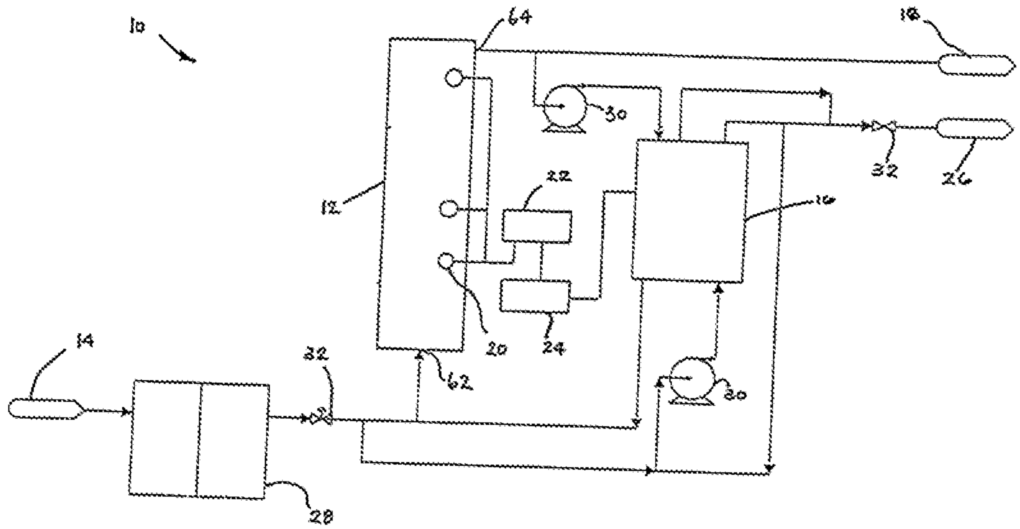

FIG. 1

Figure 1 depicts a process flow diagram of a water treatment system having a reservoir system 12 and an electrochemical device 16.

Appellants' Specification also discusses operating a ED device below a limiting current density and using a controller to maintain the current density below the limiting current density, which, in turn, eliminates or at least reduces water splitting in an ED device (Spec. 3, ll. 4-19; 15, l. 22-16, l. 4).

The Examiner maintains the following rejections:

1. claims 1, 3[2], and 8-10[3] under 35 U.S.C. § 103(a) as obvious over Hark[4] in view of Batchelder[5]; and

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[2] The Final Office action lists the rejected claims as claims 1-3 and 8-10. The Examiner acknowledges in the Answer that claim 2 has been cancelled (Ans. 3).

[3] Appellants list and argue a rejection "B" for claims 11, 12, 13, and 27 (Br. 6, 12, and 26-28). Any such rejection that might have existed at the time of

2. claims 4-7, 11-20, 22, and 27-32 under 35 U.S.C. § 103(a) as obvious over Hark in view of Batchelder and further in view of Tamura[6] and Rela.[7]

II. FIRST REJECTION

Appellants first request review of the rejection of claims 1, 3, and 8-10[8] under 35 U.S.C. § 103(a) as obvious over Hark in view of Batchelder.

Hark discloses a water purification system, which preferably has the components and the structure shown in Figure 1 (Hark, col. 2, ll. 26-28).

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the Final Office Action (*see* Final Office Action at 4) has been withdrawn by the Examiner (Ans. 3 and 4).

[4] U.S. Patent No. 4,808,287, issued February 28, 1989, to Hark.

[5] U.S. Patent No. 6,126,805, issued October 3, 2000, to Batchelder et al.

[6] U.S. Patent No. 6,303,037 B1, issued October 16, 2001, to Tamura et al.

[7] U.S. Patent No. 6,607,668 B2, issued August 19, 2003, to Rela.

[8] Appellants further include claim 12 in the listing of rejected claims (Br. 5 and 12), but do not include claim 12 when presenting arguments directed towards the first rejection (Br. 22-26).

Figure 1 of Hark is reproduced below.

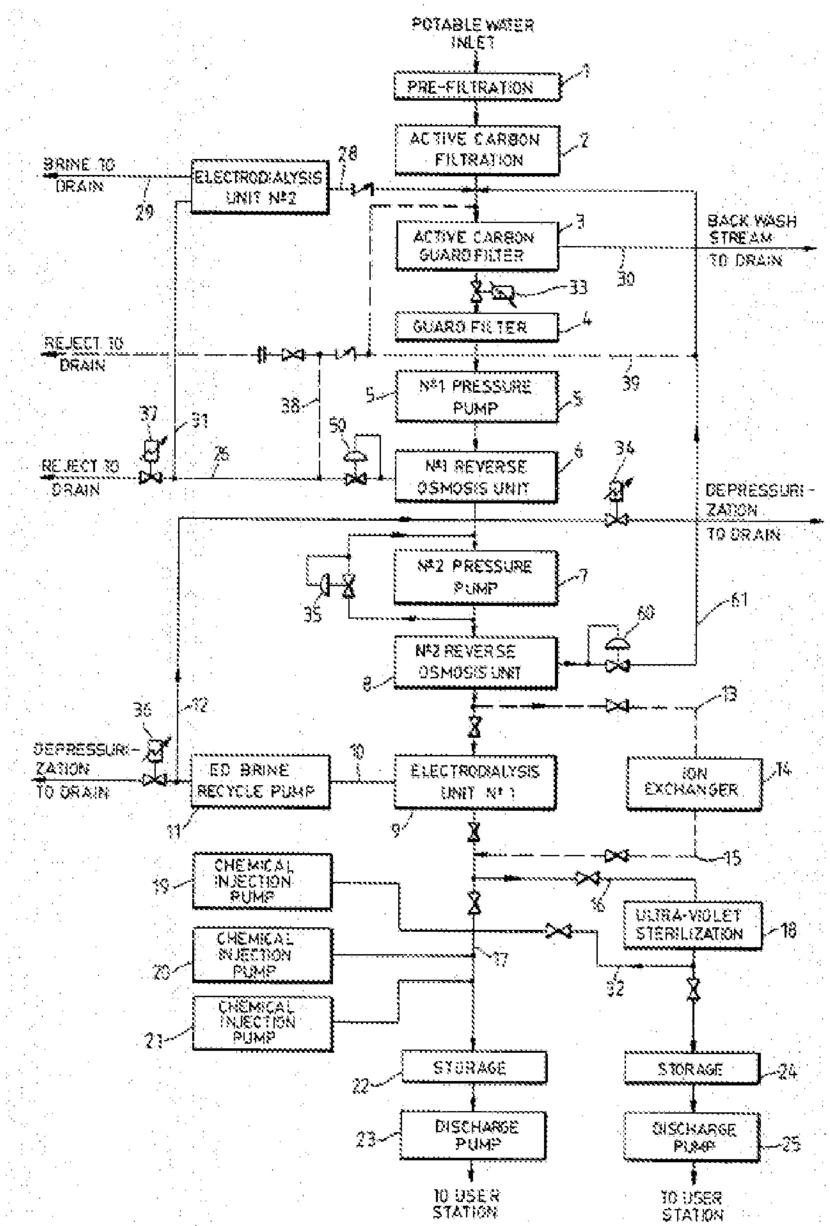


Figure 1 depicts a schematic drawing of a purification process (Hark, col. 2, ll. 21-22).

Batchelder discloses a variety of different techniques for improving electrodialysis ("ED") apparatus and systems, including improved filled cell electrodialysis apparatus and systems (also known as electrodeionization or "EDI") (Batchelder, col. 1, ll. 15-20).

Claim 1

Appellants initially present arguments with respect to claim 1 (*see* Br. 23-25).

Claim 1 is reproduced below:

1. A method of producing treated water comprising:

introducing water from a point of entry into a reservoir system and an electrochemical device;

removing at least a portion of any undesirable species from the water in the electrochemical device while suppressing hydroxyl ion generation to produce treated water;

storing at least a portion of the treated water in the reservoir system; and

distributing at least a portion of the water from the reservoir system to a point of use.

A. ISSUES ON APPEAL

Appellants initially contend that the Examiner has failed to establish a prima facie case of obviousness with respect to claim 1 (Br. 10). Specifically, one issue on appeal arising from the contentions of Appellants and the Examiner is: have the Appellants shown that the Examiner reversibly erred in finding a proper reason for combining the teachings of Hark and Batchelder? (*See* Br. 23-24; Reply Br. 8-9).

The other issue on appeal arising from the contentions of Appellants and the Examiner with respect to claim 1 is: have Appellants shown that the Examiner reversibly erred in interpreting the phrase "introducing water from a point of entry into a reservoir system and an electrochemical device," such

that the storage tanks 22 and 24 taught by Hark would constitute a "reservoir system" within the meaning of claim 1? (*See* Br. 25; Reply Br. 11).

B. FACTUAL FINDINGS

In addition to the teachings of Hark and Batchelder discussed above, the following Findings of Fact (FF) are relevant to deciding the above identified issues on appeal:

Issue 1: Reason to combine

1. Hark describes a process of purifying water from a municipal water supply stream in which water enters a series of filters, absorption units, and reverse osmosis membranes and is further purified in an electrodialysis (ED) unit 9 (Hark, Fig. 1; col. 1, l. 49 to col. 2, l. 12). The water entering the ED unit 9 of Hark is already very clean (Hark, col. 2, ll. 8-12).

2. Hark recognizes a problem of contaminant buildup on the plates within the ED unit and discloses reversing the electric current to clean off the contaminants (Hark, col. 4, ll. 38-41).

3. Batchelder explains that

> In order to maximize the utilization of ED apparatus it is desirable to operate at the highest possible current densities. However as the limiting current density is approached it is found that water is dissociated ("split") into hydrogen ions and hydroxide ions at the interfaces between the (conventional) anion exchange ("AX") membranes and the diluting streams. The hydrogen ions pass into the diluting streams and the hydroxide ions into the adjacent solutions which are being enriched in ions (the "concentrate, concentrated, concentrating or brine solutions or streams" as known in the art). Since brackish water may often contain calcium bicarbonate there is a tendency therefore for calcium carbonate to

> precipitate at those surfaces of the (conventional) AX membranes which are in contact with the concentrating streams.

(Batchelder, col. 1, l. 62 to col. 2, l. 10).

4. Batchelder teaches that methods are known to address precipitates that form on conventional anion exchange membranes when hydroxyl ions are generated, particularly the method of reversing the electric current, which is the same method that is taught by Hark for cleaning contaminants and buildup off the plates of the ED unit (Batchelder, col. 2, ll. 10-19; Hark, col. 4, ll. 38-41).

5. Batchelder describes various embodiments of electrodialysis (ED) units for various functions such as softening, de-nitrifying, or demineralizing water as well as for other uses (col. 4, ll. 10-36; col. 12, ll. 54-61). Batchelder discloses various types of membranes, some filled with various types of ion exchange granule packings (filled cell ED), and various ways of operating the ED units depending on the membranes, packings, and problem to be solved (Batchelder, *generally*, and, e.g., Abstract; col. 8, ll. 31-48; col. 12, ll. 54-61; Examples). Some of the methods operate so that water splitting is reduced while others operate to enhance water splitting (compare, e.g., col. 5, ll. 38-45 (anion exchange membranes operated to reduce water splitting) and col. 7, ll. 15-17 (cation exchange membranes operated to split water)).

6. After describing embodiments operating to reduce water splitting and embodiments to enhance water splitting using various types of membranes and ion exchange granules, Batchelder states that

> The performance of ED or filled cell ED can be "tailor-made" to suit the application by judicious choice among:

> conventional water splitting anion exchange membranes;
> *reduced water splitting* anion exchange membranes according to this invention;
> *conventional, low water splitting* cation exchange membranes;
> enhanced water splitting cation exchange membranes according to this invention;
> conventional water splitting anion exchange granules;
> *reduced water splitting* anion exchange granules according to this invention;
> *conventional low water splitting* cation exchange granules;
> enhanced water splitting cation exchange granules made in accordance with the chemistries discussed above.

(Batchelder, col. 8, ll. 31-48 (emphasis added)).

7. With regard to the reduced water splitting anion exchange membranes, Batchelder discloses

> that anion exchange membranes, which have at least in those surfaces which contact the liquid in the diluting compartments only certain quaternary ammonium (also called "nitronium" or "quaternary nitronium") and/or certain quaternary phosphonium groups, exhibit reduced water splitting during extended operation with clean water at currents near or above the Cowan-Brown limiting current.

(Batchelder, col. 5, ll. 38-45.)

Issue 2: Scope of the first clause of claim 1

8. The first clause of claim 1 reads: "introducing water from a point of entry into a reservoir system and an electrochemical device."

9. Appellants' Specification discloses that, in accordance with one or more embodiments, the system comprises a reservoir system 12 "fluidly connected" to a point of entry 14, an electrodeionization device (EDI) 16 "fluidly connected" to a point of entry 14 and the reservoir system 12 (Spec. 3, ll. 10-12; 5, ll. 12-15; Figure 1).

10. In certain embodiments of the Specification, a pretreatment system 28 is typically fluidly connected upstream of reservoir system 12 or electrodeionization device 16 (Spec. 5, ll. 29-31). Figure 1 shows a pretreatment system 28 downstream of point of entry 14 and upstream from both reservoir system 12 and electrochemical device 16 (Fig. 1).

11. According to the Specification, reservoir system 12 is fluidly connected, "typically" at an upstream end, to a point of entry (Spec. 5, ll. 12-14). The Specification also discloses that the electrodeionization device 16 "typically" removes undesirable species from water flowing from point of entry 14 (Spec. 5, ll. 20-22).

12. Hark teaches introducing water from a point of entry into electrodialysis unit No. 1 (ED unit 9) and from the ED unit 9 into one of two storage reservoirs 22 and 24 (Hark, col. 4, ll. 58-65; Figure 1).

C. PRINCIPLES OF LAW

"On appeal to the Board, an applicant can overcome a rejection by showing insufficient evidence of prima facie obviousness or by rebutting the prima facie case with evidence of secondary indicia of nonobviousness." *In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) (emphasis omitted). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including non-preferred embodiments. *Merck & Co v. Biocraft Labs.*, 874 F.2d 804, 807 (Fed. Cir. 1989).

The claims, not the specification, measure the protected patent right to exclude others. *Novo Nordisk of N. Am., Inc. v. Genentech, Inc.*, 77 F.3d 1364, 1369 (Fed. Cir. 1996). Claim interpretation begins with the language of the claim itself. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir.

2005) ("To begin with, the context in which a term is used in the asserted claim can be highly instructive.").

Further, the claim language must be given its broadest reasonable meaning. *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997) ("[A]s an initial matter, the PTO applies to the verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant's specification."). "Construing claims broadly during prosecution is not unfair to the applicant . . . , because the applicant has the opportunity to amend the claims to obtain more precise claim coverage." *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004).

Our reviewing court has repeatedly emphasized that it is not appropriate to read embodiments from the specification into the claims. *Phillips*, 415 F.3d at 1323 ("[A]lthough the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments.").

D. ANALYSIS

Issue 1: Reason to combine

The Examiner concludes that it would have been obvious for one of ordinary skill in the art to have operated the electrochemical device taught by Hark below a limiting current density "to minimize excessive water splitting, or formation of hydroxyl ions, as taught by Batchelder, to further limit the amount of precipitation occurring on the EDI surfaces and downstream of the device especially in the concentrating stream, so as to

optimize the EDI operation in the removal of salts and other contaminants." (Ans. 7.)

We find the reasoning of the Examiner sufficient to establish a prima facie case of obviousness with respect to claim 1. Batchelder provides sufficient evidence that one of ordinary skill in the art would have understood that water splitting occurs at conventional anion exchange membranes when an electrochemical device (particularly an ED or EDI unit) is operated at conditions near or above the limiting current density, causing precipitates to form (FF 3-7). Accordingly, one of ordinary skill in the art would have also recognized that simply operating an ED or EDI unit below the limiting current density would have avoided water splitting and the precipitates that form as a result. Accordingly, we find the Examiner's findings and conclusions to be reasonable.

Moreover, Batchelder teaches using particular quaternary ammonium or phosphonium functional groups to form anion exchange membranes or granules that reduce the amount of water spitting that takes place at the anion exchange membrane (FF 7). Batchelder would have instructed one of ordinary skill in the art as to a preferred quaternary ammonium functional group which would foster reduced water splitting in the ED unit of Hark (FF 5-7). Accordingly, Batchelder would have suggested suppressing hydroxyl ion generation to one of ordinary skill in the art, as recited in claim 1.

In contending that the Examiner has not established a prima facie case of obviousness, Appellants argue that (a) because Hark teaches a method for removing precipitating products caused from reactions with hydroxyl ions, suppressing hydroxyl ion generation would be unnecessary and undesirable in the Hark system (Br. 23); (b) the techniques of Batchelder that seek to

split water "run against suppressing hydroxyl ion generation." (Br. 24); (c) Batchelder's teaching that it is desirable to operate at "the highest possible current density" discredits the assertion of the Examiner (Br. 24); (d) Batchelder evidences that one of ordinary skill in the art would have been motivated to split water rather than suppress hydroxyl ion generation (Br. 24).

We find Appellants' arguments unpersuasive. First, Hark as well as Batchelder teach reversing the current to remove buildup formed at conventional anion exchange membranes due to water splitting (FF 4), the problem of contaminant build up due to water splitting was a known problem in the art. One of ordinary skill in the art would have recognized that either operating the ED unit below a limiting current density or using the reduced water splitting membranes and granules, both of which are suggested by Batchelder, would solve the known problem of precipitates forming when using conventional anion exchange membranes in the ED unit, and using reduced water splitting anion exchange membranes and granules would be a reasonable alternative, or addition, to reversing the electrical current method conventionally used (FF 2-7). "[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007).

The teaching in Batchelder of increasing the water splitting at the cation exchange membrane is only one of several proposed options for a "tailor-made" ED or EDI unit (FF 6). An alternative teaching includes using conventional cation exchange membranes with very little water splitting and

reduced water splitting anion exchange membranes, which would constitute an overall suppression of hydroxyl ion generation (FF 7). Particular examples and preferred embodiments do not constitute a teaching away from a broader disclosure or other disclosed embodiments. *In re Susi*, 440 F.2d 442, 446 n.3 (CCPA 1971).

Despite the fact that Batchelder teaches that it is most desirable to operate at the highest possible current density, Batchelder recognizes the problem of operating at current densities approaching the limiting current density (FF 3). Moreover, while claim 1 requires suppressing hydroxyl ion generation, claim 1 is not limited to operating below the limiting current density. Batchelder teaches that using particular anion exchange membranes or granules causes reduced water spitting when the applied current density is near or above the limiting current density (FF 5-7).

Accordingly, the teachings of Batchelder would have suggested two alterative methods to reducing hydroxyl ion suppression, operating below the limiting current density or using alternative anion exchange membranes. While Batchelder would have also suggested facilitating water splitting using conventional anion exchange membranes and/or increased water splitting cation exchange membranes (FF 7), Batchelder does not teach facilitating water splitting to the exclusion of suppressing water splitting, as suggested by Appellants.

Thus, Appellants have not shown that the Examiner reversibly erred in finding that the prior art provides a proper reason for combining the teachings of Hark and Batchelder.

Issue 2: Scope of the first clause of claim 1

Appellants also argue that, although Hark discloses storing treated water, this reference "does not disclose introducing or storing water from a point of entry into a reservoir as well as into an electrochemical device." (Br. 25.) The Examiner responds that the claims do not preclude "the electrochemical device being either upstream or downstream of a system of components including a reservoir" (Ans. 25).

Based upon the words of the claim and what is disclosed in the Specification, we determine that the Examiner's interpretation of claim 1 is consistent with the broadest reasonable interpretation of the claim language as read in light of the Specification as it would be interpreted by one of ordinary skill in the art. We decline to read into claim 1 the preferred introduction method taught by Appellants' Specification, in which water from a point of entry 14 is split into two streams, one leading into an electrochemical device 16, and the other leading into a reservoir 12 (FF 9).

As a first matter, the words of the claim itself evince a broader meaning. The claim language "introducing water from a point of entry into a reservoir and an electrochemical device" is not so precise as to require that water be split into two streams, one flowing into the reservoir, the other flowing into electrochemical device. Rather, the language encompasses a single stream flowing from one component to another. Water entering either the reservoir or the electrochemical device and proceeding from one to the other ultimately originates from the point of entry. Each component within the system receives water from the point of entry.

The Specification supports our interpretation of the claim language. Appellants' Specification defines the point of entry at 14 and describes

embodiments with a pretreatment system 28 between the point of entry 14 and reservoir 12 and electrochemical device 16 (FF 10). The claim does not appear to exclude locating other components such as the pretreatment system 28, or one of the recited components (reservoir or electrochemical device), between the point of entry and the other of the recited components.

Appellants' use of the terms "typically" in the Specification for describing the fluid connections between the components (FF 11) provides further evidence that embodiments other than the splitting flow shown in Figure 1 are encompassed.

Moreover, the Specification speaks in terms of fluid connections (FF 9). Within a system of water treatment, each of the devices in which water flows from the point of entry to the point of exit is "fluidly connected." Whether the components are upstream or downstream from each other, they remain fluidly connected to the point of entry such that water introduced at the point of entry flows into all the fluidly connected components, including the reservoir and electrochemical device.

It is axiomatic that during examination proceedings, claims are given their broadest reasonable interpretation consistent with the specification. *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d at 1364. Although claims are to be interpreted in light of the specification, limitations from the specification are not to be read into the claims. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). An applicant seeking a narrower construction must either show why the broader construction is unreasonable or amend the claim to expressly state the scope intended. *In re Morris*, 127 F.3d at 1057; *see also In re Icon Health and Fitness, Inc.,* 496 F.3d 1374, 1379 (Fed. Cir. 2007) ("as applicants may amend claims to narrow their scope, a broad

construction during prosecution creates no unfairness to the applicant or patentee.”).

Appellants point us to no language within the Specification that limits the words of the claim as argued and we find none.

Since Hark teaches water from a potable water inlet (point of entry) entering upstream from ED unit 9 (an electrochemical device) and also upstream from two storage units 22 and 24 (a reservoir system) (FF 12), Hark clearly teaches an embodiment falling within the broad scope of claim 1.

Appellants have not shown that the Examiner reversibly erred in interpreting the phrase “introducing water from a point of entry into a reservoir system and an electrochemical device,” and the storage tanks 22 and 24 taught by Hark would constitute a “reservoir system” within the meaning of claim 1.

Appellants state that dependent claims 3 and 8-10 “would also not have been obvious over Hark and Batchelder for at least the same reasons discussed above” with respect to independent claim 1 (Br. 25; Reply Br. 11). Thus, for the same reasons, Appellants have also not shown that the Examiner reversibly erred in rejecting claims 3 and 8-10 as being obvious over the teachings of Hark and Batchelder.

Claim 8

After stating that dependent claims 3 and 8-10 would not have been obvious “for the reasons discussed above,” Appellants’ Brief further states that “Hark and Batchelder fail to disclose or suggest a method of producing treated water comprising storing at least a portion of the treated water in a pressurized reservoir system” (Br. 25; *see also* Reply Br. 12). Appellants do

not identify which of the dependent claims they are addressing with this argument. However, claim 8 is the only one of claims 3 and 8-10 including a limitation to a pressurized reservoir system. Therefore, we resolve the issue raised in so far as it pertains to claim 8.

Claim 8 is reproduced below:

> 8. The method of claim 1, wherein the act of storing at least a portion of the treated water comprises storing at least a portion the treated water in a pressurized reservoir system.

A. ISSUE ON APPEAL

With respect to claim 8, the issue on appeal arising from the contentions of Appellants and the Examiner is: have the Appellants shown that the Examiner reversibly erred in determining that it would have been obvious to one of ordinary skill to store water in a pressurized reservoir system based on the teachings of Hark and Batchelder?

B. FACTUAL FINDINGS

The following Findings of Fact (FF) are relevant to deciding the above identified issue on appeal:

13. Appellants' Specification defines "pressurized" as having a pressure greater than atmospheric pressure and states that a "pressurized reservoir system has an internal pressure that is greater than atmospheric pressure" (Spec. 6, ll. 10-12).

14. Appellants' Specification states that the pressure in a pressurized reservoir system can be created by any method, including pressurizing with a water pump or elevating the water source, thus creating head pressure (Spec. 6, ll. 12-15).

15. Hark teaches the presence of discharge pumps 23 and 25, which function as "send out pumps" to a user station (Hark, col. 4, ll. 58-65;

Figure 1). These pumps apply negative pressure to storage 22 and 24 to facilitate sending the water out of the system.

16. Appellants refer to a portion of Hark that discloses a process for depressurizing the water purification system upon shutdown to avoid damage to the membranes within the reverse osmosis units (Br. 25; Reply Br. 12; Hark, col. 5, ll. 3-53). However, Hark does not disclose that any depressurization occurs within the water system during operation (*see generally* Spec.).

C. PRINCIPLES OF LAW

In addition to the Principles of Law recited above with respect to claim 1, the following Principles of Law are particularly relevant to the issue presented above with respect to claim 8.

The question of obviousness cannot be approached on the basis that an artisan having ordinary skill would have known only what they read in the references, because such artisan is presumed to know something about the art apart from what the references disclose. *See In re Jacoby,* 309 F.2d 513, 516 (CCPA 1962). Nor is it necessary that suggestion or motivation be found within the four corners of the references themselves. Indeed, a conclusion of obviousness may be made from common knowledge and common sense of the person of ordinary skill in the art without any specific hint or suggestion in a particular reference. *See In re Bozek,* 416 F.2d 1385, 1390 (CCPA 1969).

D. ANALYSIS

Pressurizing a reservoir, for example by using a pump or elevating the reservoir to create head pressure as disclosed in Appellants' Specification (FF 14), would have been well-known and commonplace to one of ordinary

skill in the art of water purification systems. To presume otherwise would be to disregard the presumed skill and knowledge of the ordinary artisan. Hark teaches the use of discharge pumps 23 and 25 to apply negative pressure to storage 22 and 24 (FF 15). Even without an explicit teaching, one of ordinary skill in the art would have recognized that applying positive pressure, rather than negative pressure, would also result in withdrawing the water from storage 22 and 24 of Hark. In other words, it would have been obvious to one of ordinary skill in the art to have pressurized storage tanks 22 and 24 as an alternative to using discharge pumps 23 and 25 positioned downstream from storage 22 and 24.

Moreover, Appellants' Specification states that "pressurized" means at greater than atmospheric pressure (FF 13), and claim 8 would encompass a reservoir system at very slightly above atmospheric pressure because the claim is not limited to any particular degree of pressure above atmospheric. Without any evidence to the contrary, we accept the Examiner's reasoning that any of the upstream pumps taught by Hark would apply an overall pressure to the water system that would cause storage 22 and 24 to be pressurized to at least a very small amount above atmospheric pressure. Appellants' arguments directed to depressurization of the system taught by Hark (Br. 25; Reply Br. 12) are unpersuasive, as this section of Hark refers only to depressurization of the system during shutdown, and does not reflect any depressurization during operation (FF 15).

Accordingly, Appellants have not shown that the Examiner reversibly erred in rejecting claim 8 as obvious over the teachings of Hark and Batchelder.

Claim 10

To the best of our understanding, Appellants' Reply Brief appears to raise an additional argument with respect to claim 10 (Reply Br. 12). Appellants refute the Examiner's statement that "Hark discloses EDI device units 1 and 2" (Reply Br. 12; ans. 8).

Claim 10 is reproduced below:

> 10. The method of claim 1, wherein the electrochemical device comprises an electrodeionization device.

A. ISSUE ON APPEAL

With respect to claim 10, the dispositive issue on appeal arising from the contentions of Appellants and the Examiner is: have Appellants shown that the Examiner reversibly erred in determining that it would have been obvious to one of ordinary skill in the art to use an electrodeionization device as the electrochemical device based on the teachings of Hark and Batchelder?

B. FACTUAL FINDINGS

The following Findings of Fact (FF) are relevant to deciding the above identified issue on appeal:

17. Hark does not teach using EDI units as the ED units (*see generally* Hark).

18. However, Hark provides no statement against the use of an EDI unit (*see generally* Hark).

19. Batchelder states that

> The invention pertains to improved electrodialysis ("ED" including "EDR") apparatus and systems including improved filled cell electro-dialysis apparatus and systems and to improved processes

> which use such apparatus and systems. (Filled cell ED is also known as electrodeionization ("EDI").

(Batchelder, col. 1, ll. 15-21).

20. Batchelder includes examples in which an EDI unit is used for water softening, water denitrification and water purification (Batchelder, Examples 9-11, col. 25, l. 15-col. 27, l. 60).

C. PRINCIPLES OF LAW

The same Principles of Law presented above with respect to claim 1 are also relevant to the issue presented above with respect to claim 10.

D. ANALYSIS

Hark discloses the use of a generic electrodialysis ("ED") unit used in the water treatment process, but does not disclose the particular use of an electrodeionization ("EDI") device (FF 12 and 17). However, Batchelder teaches that EDI is a type of ED, particularly "filled cell" ED (FF 19). Batchelder further teaches the use of an EDI unit particularly for the purpose of water purification (FF 20). To one of ordinary skill in the art, using an EDI unit in the water treatment process of Hark would have been no more than the predictable use of a known ion exchange device for the intended purpose of water purification, an obvious modification of the teachings of Hark. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007) ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."). We find nothing in Hark that would discourage this obvious substitution (FF 18). Accordingly, Appellants have not shown that the Examiner reversibly erred in rejecting claim 10 as obvious over the teachings of Hark and Batchelder.

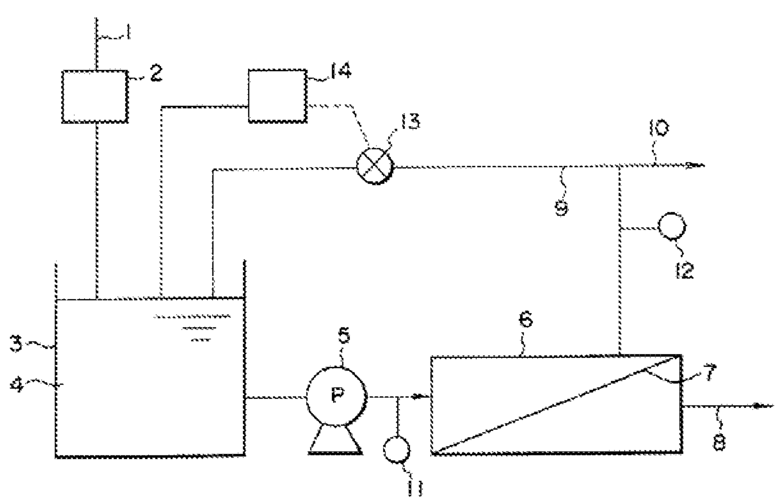
III. SECOND REJECTION

Appellants also request review of the second rejection maintained by the Examiner, namely the rejection of claims 4-7, 11-20, 22, and 27-32 under 35 U.S.C. § 103(a) as obvious over Hark in view of Batchelder and further in view of Tamura[9] and Rela.[10]

Tamura teaches the process and equipment for reverse osmosis purification of water by maintaining the pH of the concentrate stream to reduce silica precipitates (Tamura, col. 1, ll. 6-9, col. 2, ll. 20-30). Figure 2 of Tamura illustrates that water from inflow piping 1 and a concentrate stream (in piping 9) from a reverse osmosis module 6 are fed to a water feed tank 3, a pH sensor 13 measures the pH of the concentrate stream, and a pump 14 adds acid to tank 3 to adjust the pH based on input from the pH sensor 13 (Tamura, col. 4, l. 56-5, l. 23).

Figure 2 of Tamura is reproduced below.

F I G. 2



[9] U.S. Patent No. 6,303,037 B1, issued October 16, 2001, to Tamura et al.

[10] U.S. Patent No. 6,607,668 B2, issued August 19, 2003, to Rela.

Figure 2 depicts a flow diagram showing an example of reverse osmosis equipment that may be used to carry out a reverse osmosis process (Tamura, col. 4, ll. 25-28).

Rela teaches a water purifier which includes an EDI module 54 and a control system for controlling the individual components of the water purifier, including controlling the electrical voltage and current of the EDI module 54 (Rela, col. 1, ll. 5-10, col. 2, ll. 41-44, col. 3, ll. 62-67).

Figure 1 of Rela is reproduced below.

FIG. 1

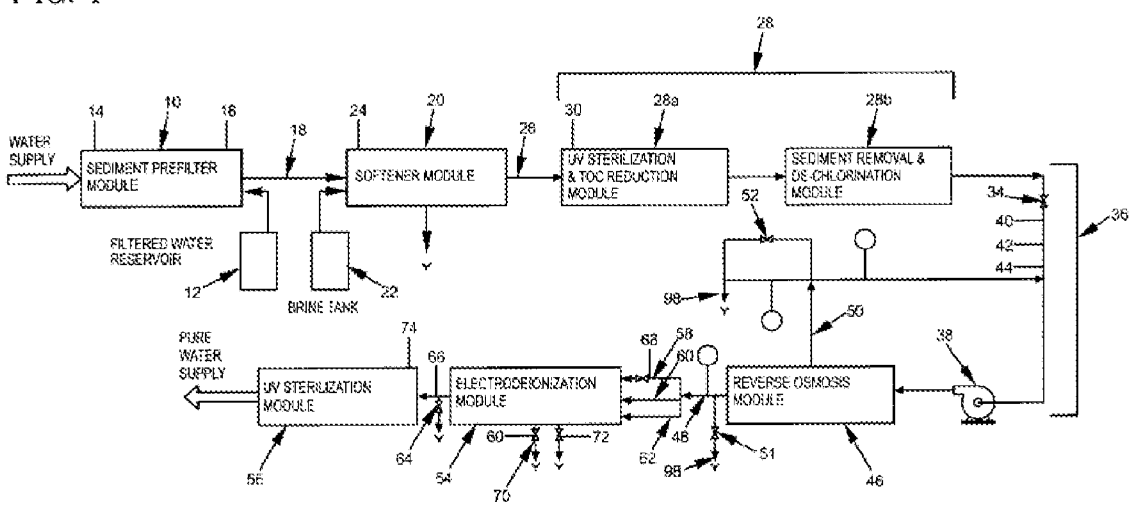


Figure 1 of Rela depicts a flow diagram of a water purification process in a water purifier (Rela, col. 5, ll. 19-20).

Claims 4-7 and 28

Appellants state that claims 4-7 and 28 are patentable based on their dependency on claim 1 (Ans. 28-29; Reply Br. 13). Accordingly, Appellants have also not shown that the Examiner reversibly erred in rejecting claims 4-7 and 28 as being obvious over the teachings of Hark, Batchelder, Tamura and Rela.

Claim 11

With respect to the second rejection, Appellants initially present arguments with respect to claim 11 (Br. 26-28; Reply Br. 13-15).

Claim 11 is reproduced below:

11. A method of producing treated water comprising:

introducing water from a point of entry into a reservoir;

introducing a portion of the water from the reservoir into an electrochemical device;

applying an electrical current below a limiting current density through the electrochemical device to promote removal of any undesirable species from the water and produce treated water; and

maintaining the electrical current below the limiting current density to produce the treated water.

A. ISSUES ON APPEAL

Appellants contend that the Examiner has failed to establish a prima facie case of obviousness with respect to claim 11 (Br. 26). Specifically, one issue on appeal arising from the contentions of Appellants and the Examiner is: have the Appellants shown that the Examiner reversibly erred in determining that one of ordinary skill in the art would have operated an electrochemical device "below the limiting current density"? (*See* Br. 27-28; Reply Br. 8-9).

The other issue on appeal arising from the contentions of Appellants and the Examiner with respect to claim 11 is: have the Appellants shown that the Examiner reversibly erred in determining that the prior art references would have suggested to one of ordinary skill in the art the steps of "introducing water from a point of entry into a reservoir" and "introducing a

portion of the water from the reservoir into an electrochemical device"? (Br. 28; Reply Br. 14).

B. FACTUAL FINDINGS

In addition to the facts presented above regarding Hark, Batchelder, Tamura, and Rela, the following additional Findings of Fact are relevant to deciding the above identified issues on appeal:

Issue 1: Operating below a "limiting current density"

21. Appellants' Specification states that a "limiting current density" is "the current wherein water dissociates" (Spec. 6, ll. 18-19).

22. Batchelder defines the "limiting current density" as the current density corresponding to when the concentration of electrolyte at the membrane/solution interface is essentially zero or when the maximum rate of ions diffuse from the solution at the interface between the membrane and the solution being depleted of ions (Batchelder, col. 1, ll. 40-49).

23. Batchelder states that "as the limiting current density is approached it is found that water is dissociated ("split") into hydrogen ions and hydroxide ions at the interfaces between the (conventional) anion exchange ("AX") membranes and the diluting streams" (Batchelder, col. 1, l. 65 to col. 2, l. 2).

24. Batchelder also describes that commercial filled ED apparatus (EDI apparatus) operating at current densities which are less than the limiting current densities for such apparatus selectively remove divalent ions. These commercial apparatus use standard ion exchange granules known to be selective to divalent ions as compared to monovalent ions of the same charge sign. But there is a problem with these systems. At high recoveries of demineralized water, poorly soluble calcium sulfate

precipitates in the concentrate compartments, generally on and/or in the surface of one or the other of the membranes (Batchelder, col. 9, ll. 19-32).

25. Batchelder overcomes the problem of precipitation by packing an EDI unit with granules which are selective to monovalent ions as compared with divalent ions of the same charge sign (such as certain quaternary ammonium and/or quaternary phosphonium functional groups on the surface regions of the granules) during operation of an EDI unit at current densities which are substantially less than the limiting current density of such filled diluting compartments (Batchelder, col. 9, ll. 33-41 and 64-67).

26. Batchelder includes examples of water softening or water denitrification and an example of water purification using ED stacks incorporating the monovalent anion selective granules. The water purification example (Example 11) uses such stacks in combination a highly polarized second ED stack. The direct electric current applied to the stacks containing the monovalent anion selective granules is "about 25% of the limiting current." (Batchelder, Examples 9-11, col. 25, l. 15-col. 27, l. 60; *see also* col. 11, l. 21 to col. 12, l. 24 (indicating that these stacks are operated at current densities substantially less than the limiting current density at col. 11, ll. 30-32).)

Issue 2: Introducing water into a reservoir

27. Appellants' Specification does not define the term "reservoir," but instead uses the similarly undefined term "reservoir system 12" throughout (*see generally* Spec.).

28. Rela and Tamura teach the use of reservoirs (reference numerals 12 and 3, respectively) to store water for use within a water

purification system (Rela, col. 6, ll. 2-8; Figure 1; Tamura, col. 4, ll. 57-60; Figure 2).

29. In Hark, the water enters a pre-filtration chamber 1 to remove suspended solids, which may be, for example, "a cellulose fiber wound material . . . placed into a sump assembly" (Hark, col. 2, ll. 41-46).

C. PRINCIPLES OF LAW

The same Principles of Law presented above with respect to claim 1 are also relevant to the issues presented above with respect to claim 11.

D. ANALYSIS

Issue 1: Operating below a "limiting current density"

Initially, we note that the definitions of the term "limiting current density" provided by Appellants (FF 21) and by Batchelder (FF 22) are not identical, and care must be used not to conflate the two. However, on the present record, the two definitions are not necessarily inconsistent (*see e.g.*, FF 23).

As with claim 1 above, the Examiner contends that it would have been obvious for one of ordinary skill in the art to have operated the electrochemical device taught by Hark below a limiting current density as suggested by Batchelder, to reduce water splitting and thus limit the amount of precipitation occurring on the surface and downstream of the device to optimize operation thereof (Ans. 7; *see also* Ans. 25 (indicating the Examiner has addressed Appellants' position with respect to the "limiting current density" limitation in his assertions regarding claim 1)).

We find the reasoning of the Examiner sufficient to establish a prima facie case of obviousness with respect to claim 11. Batchelder provides sufficient evidence that one of ordinary skill in the art would have

understood that water splitting occurs at conventional anion exchange membranes when an electrochemical device (particularly an ED or EDI unit) is operated at conditions near or above the ("Batchelder") limiting current density, causing precipitates to form (FF 3-7). Accordingly, one of ordinary skill in the art would have also recognized that simply operating an ED or EDI unit below the ("Batchelder") limiting current density would have avoided water splitting and the precipitates that form as a result. Under these conditions, the ED would be operated below Appellants' "limiting current density." Accordingly, we find the Examiner's findings and conclusions to be reasonable.

Moreover, Batchelder provides further evidence that it was known in the art to operate ED apparatus substantially below the limiting current density although there are problems of precipitation with such systems (FF 24). Batchelder also describes ED systems including packings including monovalent anion selective granules that overcome the precipitation problem of the commercial units (FF 25). Batchelder exemplifies ED systems including the improved ED stacks for softening, denitrifying, and ultrapurifying water (FF 26). ED stacks within the exemplified apparatus containing the improved granules are operated at substantially less than the limiting current density, e.g., at about 25%, of the limiting current (FF 26). This evidence further supports the Examiner's finding of a suggestion within Batchelder for operating an ED unit below the limiting current density as defined by Appellants. Despite the fact that Batchelder teaches that it is most desirable to operate at the highest possible current density, Batchelder recognizes the problem of operating at current densities approaching the

limiting current density (FF 3) and explicitly teaches operating below a limiting current density (FF 26).

We conclude that Appellants have not shown reversible error in the Examiner's rejection as to Issue 1, operating below the limiting current density, as defined by Appellants.

Issue 2: Introducing water into a reservoir

The Examiner states that "Hark discloses storing of water between the point of entry (inlet to prefiltration unit 1) and the portion of the system encompassing the reverse osmosis units and the EDI Units 1 and 2, by providing solenoid valve 33 that opens and closes to prevent water flow downstream towards these units, and storing water within chambers and sumps of upstream filter chambers 1,2,3 and 4 and connecting conduits (figure, col. 2, lines 41-50 and column 5, lines 8-15)" and that "[i]t would have been obvious to have facilitated the storing of water upstream of the reverse osmosis and EDI units or modules that occurs in Hark, by providing a reservoir tank, as taught by Rela and Tamura, in order to facilitate maintaining of optimum pressures upstream of the reverse osmosis units, for efficient operation of the reverse osmosis module units, and assure accurate pump discharge and pressure conditions" (Ans. 12).

Appellants assert that the references fail to disclose or suggest a method of producing treated water comprising introducing water from a point of entry into a reservoir and introducing a portion of the water from the reservoir into an electrochemical device (Br. 28; Reply Br. 14).

Appellants' Specification does not define the term "reservoir" (FF 27). While Figure 1 of Appellants' Specification appears to illustrate a "reservoir system 12" as a tank (*see* Figure 1), we decline to require a

reservoir be limited to the structure or location shown in Figure 1. The common and ordinary meaning of the term "reservoir" is not limited to any particular structure and would encompass any structures in which water is kept or stored.[11] Considering the broad meaning of the term "reservoir" and considering that using reservoirs in water purification systems for storing water is well-known to one of ordinary skill in the art as evidenced by Hark, Rela, and Tamura (FF 12 and 28), we agree with the Examiner that adding a reservoir to any location within the water system taught by Hark would have been no more than the predictable use of known reservoirs for the intended purpose of storing water. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416 (2007) ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.").

Further, Hark clearly teaches that pre-filtration chamber 1 may be a "sump assembly," which would constitute a reservoir, between the potable water inlet and either of the ED units 9 and 27 (FF 29). Further, the term "reservoir" in claim 11 is sufficiently broad to encompass, for example, any portions of the water line taught by Hark where water would collect. Thus, the steps of "introducing water from a point of entry into a reservoir" and "introducing a portion of the water from the reservoir into an electrochemical device" would have been obvious to one of ordinary skill in the art from the teachings of the references.

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[11] For example, the American Heritage Dictionary of the English Language, Fourth Edition (2000), available online at www.bartleby.com, defines "reservoir" as "1. [a] natural or artificial pond or lake used for storage and regulation of water" or "2. [a] receptacle or chamber for storing a fluid."

Accordingly, Appellants have not shown that the Examiner reversibly erred in determining that the prior art references would have suggested to one of ordinary skill in the art the steps of "introducing water from a point of entry into a reservoir" and "introducing a portion of the water from the reservoir into an electrochemical device."

Appellants state that dependent claims 12-16 and 27 are not obvious for the same reasons as independent claim 11 (Br. 29; Reply Br. 15). Accordingly, for the same reasons, Appellants have also not shown that the Examiner reversibly erred in rejecting claims 12-16 and 27 as being obvious over the teachings of Hark, Batchelder, Tamura, and Rela.

Claim 17

Appellants provide separate arguments with respect to claim 17 (Br. 29; Reply Br. 15).

Claim 17 is reproduced below:

17. A water treatment system comprising:

a reservoir system fluidly connected to a point of entry, the reservoir system comprising a plurality of zones having water contained therein with differing water quality levels;

an electrochemical device fluidly connected to the point of entry and the reservoir system;

a power supply for providing an electrical current to the electrochemical device; and

a controller for regulating the electrical current below a limiting current density.

Appellants assert that "none of [the references] discloses or suggests a reservoir system fluidly connected to a point of entry, wherein the reservoir

system comprises a plurality of zones having water contained therein with differing water quality levels" and that "none of Hark, Batchelder Tamura, and Rela discloses or suggests a water treatment system comprising a controller for regulating the electrical current provided to an electrochemical device at below a limiting current density of the device" (*see* Br. 29; Reply Br. 15). Appellants further argue that Batchelder teaches promoting water splitting rather than reducing water splitting (Reply Br. 15).

However, Appellants do not address the Examiner's specific positions articulated in the Final Office Action and/or Answer or explain why the Examiner's positions are deficient. Specifically, Appellants do not address the Examiner's finding that Hark describes the claimed plurality of zones as set forth in the Answer at pages 13-14, nor the Examiner's findings and conclusions regarding the obviousness of incorporating a controller based upon the combined teachings of Rela, Tamura, and Hark as set forth in the Answer at page 16. Merely pointing out what a claim recites is not considered an argument for separate patentability of the claim. 37 C.F.R. § 41.37(c)(1)(vii). In any event, Appellants' conclusory statements fall well short of rebutting the Examiner's prima facie case of obviousness.

Accordingly, Appellants have not shown that the Examiner reversibly erred in rejecting claim 17 as being obvious over the teachings of Hark, Batchelder, Tamura, and Rela.

Claim 22

Appellants also provide separate arguments with respect to claim 22. (Br. 29; Reply Br. 15).

Claim 22 is reproduced below:

22. A method of facilitating water treatment comprising:

providing a pressurizable reservoir system fluidly connectable downstream of to a point of entry and further fluidly connectable upstream of a distribution system fluidly connect to at least one point of use;

providing an electrochemical device fluidly connected downstream of the pressurizable reservoir system;

providing a power supply for providing an electrical current to the electrochemical device; and

providing a controller for regulating the electrical current below a limiting current density.

A. ISSUES ON APPEAL

With respect to claim 22, one issue on appeal arising from the contentions of Appellants and the Examiner is: have Appellants shown that the Examiner reversibly erred in determining that one of ordinary skill in the art would have "provided a controller for regulating the electrical current below a limiting current density," as recited in claim 22? (Br. 30; Ans. 16.)

The other issue on appeal arising from the contentions of Appellants and the Examiner with respect to claim 22 is: have Appellants shown that the examiner reversibly erred in broadly interpreting the phrase "pressurizable reservoir system" such that the combination of references fail to teach a pressurizable reservoir system that is downstream from a point of entry and upstream from a distribution system connected to a point of use and from an electrochemical device, as recited in claim 22? (*See* Br. 30; Reply Br. 16-17).

B. FACTUAL FINDINGS

The following additional Findings of Fact are relevant to deciding the above identified issue on appeal:

30. Appellants' Specification discloses that a controller may be a microprocessor-based device that receives or sends input and output signals to components of the water treatment system (Spec. 12, ll. 25-27).

31. Rela teaches that the control system calculates electrical voltage and current required by the electrodeionization module and automatically adjusts each to achieve optimum outlet water quality, if such adjustment is necessary (Rela, col. 3, ll. 64-67, col. 10, ll. 24-27).

32. Rela teaches that the control system uses a central microprocessor (Rela, col. 11, l. 19).

33. Hark teaches that pre-filtration chamber 1 is downstream from the potable water inlet and upstream the ED units 9 and 27 and the discharge pumps 23 and 25 which deliver water to a user station (Hark, col. 2, l. 42-col. 4, l. 65; Figure 1).

C. PRINCIPLES OF LAW

The same Principles of Law presented above with respect to claim 1 are also relevant to the issues presented above with respect to claim 22.

D. ANALYSIS

Appellants state that "one skilled in the art would not have controlled an electric current applied to an electrochemical device utilized for water treatment in the manner claimed" (Br. 30; Reply Br. 16). Appellants' arguments are not persuasive for the reasons discussed above when addressing claim 11. That is, Batchelder teaches it would have been obvious to one of ordinary skill in the art to operate the electrochemical device taught by Hark at a current below a limiting current density. Further, Rela teaches a control system that regulates the electrical current provided to the EDI unit (FF 31 and 32). Rela also teaches that providing such a controller optimizes

the water quality (FF 31). One of ordinary skill in the art would have recognized that the control system taught by Rela would improve the electrochemical device, taught by Hark and modified by Batchelder to operate below a limiting current density, in the same way it improved the water purification system taught by Rela. Thus, providing a control system would have been obvious to an ordinary artisan.

Claim 22 recites a "pressurizable reservoir system." In other words, claim 22 broadly encompasses a reservoir system that is *capable* of being pressurized. One of ordinary skill in the art would recognize that almost any reservoir would be capable of being pressurized using well-known techniques. Hark teaches that pre-filtration chamber 1 is a "sump assembly" (FF 29). One of ordinary skill in the art would recognize that while not naturally pressurized, the "sump assembly" would be *capable* of being pressurized, for example by the addition of an upstream pump. Pre-filtration chamber 1 is downstream from a potable water inlet (point of entry) and upstream from ED units 9 and 27 (electrochemical devices) and discharge pumps (a distribution system), which are fluidly connected to a user station (point of use) (FF 33).

Accordingly, Appellants have not shown that the Examiner reversibly erred in rejecting claim 22 as being obvious over the teachings of Hark, Batchelder, Tamura, and Rela.

Appellants state that dependent claims 18-20 and 29-32 would not have been obvious for the same reasons as independent claim 17 (Br. 29; Reply Br. 16). Accordingly, for the same reasons, Appellants have also not shown that the Examiner reversibly erred in rejecting claims 18-20 and 29-

32 as being obvious over the teachings of Hark, Batchelder, Tamura, and Rela.

Claims 18 and 27

With respect to claims 18 and 27, Appellants separately assert that the subject matter of the recited limitations are not found in the cited prior art (*See* Br. 28; Reply Br. 16). Appellants do not address the Examiner's specific positions articulated in the Final Office Action and/or Answer or explain why the Examiner's positions are deficient. Merely pointing out what a claim recites is not considered an argument for separate patentability of the claim. 37 C.F.R. § 41.37(c)(1)(vii). In any event, Appellants' conclusory statements fall well short of rebutting the Examiner's prima facie case of obviousness. We do not consider these assertions as raising any issues on appeal for our decision.

IV. CONCLUSION

For the reasons presented above, we sustain the following rejections:

1. claims 1, 3, and 8-10 under 35 U.S.C. § 103(a) as obvious over Hark in view of Batchelder; and
2. claims 4-7, 11-20, 22, and 27-32 rejected under 35 U.S.C. § 103(a) as obvious over Hark in view of Batchelder and further in view of Tamura and Rela.

V. DECISION

We affirm the Examiner's decision.

VI. TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal maybe extended under 37 C.F.R. § 1.136(a)(1)(v)(2008).

AFFIRMED

NAGUMO, *Administrative Patent Judge, dissenting-in-part*

Because I disagree with the interpretation of the first limitation of claim 1, I respectfully dissent from the affirmance of the First Rejection. Findings of fact in this section are supported by a preponderance of the evidence of record.

Claim 1 reads:

A method of producing treated water comprising:

[a] introducing water from a point of entry into

[i] a reservoir system and

[ii] an electrochemical device;

[b] removing at least a portion of any undesirable species from the water in the electrochemical device while suppressing hydroxyl ion generation to produce treated water;

[c] storing at least a portion of the treated water in the reservoir system; and

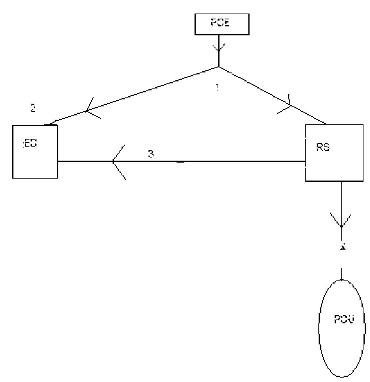
[d] distributing at least a portion of the water from the reservoir system to a point of use.

(Claims App., Br. 31; indentation and bracketed labels added.)

The majority appears to read the phrase "from a point of entry" as an adjective describing the ultimate origin of water recited in the claim. (Slip Op. 15, 3rd para., last two sentences. [12]) In my view, this reading is strained. I find it more natural to read the prepositional phrase "from a point of entry" as identifying the location from which water is introduced to the two recited

[12] "Water entering either the reservoir or the electrochemical device and proceeding from one to the other ultimately originates from the point of entry. Each component within the system receives water from the point of entry."

destinations [i] and [ii]. Reading limitation [a] so broadly that a method in which water is introduced to a reservoir system only after passing through an electrochemical device, as maintained by the Examiner (Final Rejection 3, first paragraph; hereinafter, "sequential delivery"), reads limitation [a][ii] out of the claim. Rather, properly read, the method of claim 1 requires that water from the point of entry be introduced both to the reservoir and the electrochemical device, as shown in the diagram below:



{The diagram depicts the water delivery requirements of claim 1}

While I agree with my colleagues that water need not flow from the point of entry directly to the reservoir system or directly to the electrochemical device, in that it may pass through a pre-treatment system (e.g., element 28 of Appellants' Figure 1; or the carbon filters, osmosis units, or ion exchanger shown in Hark Figure 1), I disagree that the recited "introduction" includes exclusive sequential delivery to a reservoir via an electrochemical device.

I would therefore REVERSE the rejection of claim 1 as being based on reading an incorrect interpretation of claim 1 on the process found by the Examiner to be described by Hark and I respectfully, DISSENT-IN-PART.

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